KENT
UNIVERSITY OF KENT
AT CANTERBURY

SNORS

Nasal Oral Ratiometry System

USER MANUAL

Medical Electronics Research Group

University of Kent at Canterbury

MAY 1997

CONTENTS

Introduction 3

Specification 4

Installation 5

Operation 6

Test Procedure 7

Data Retrieval 10

Real Time Screens 11

APPENDIX I - Custom Word List 12

APPENDIX II - Technical Details 13

APPENDIX III - Sample Printout 14

INTRODUCTION

The University of Kent Second Nasal-Oral Airflow Ratiometry system is an instrument for the study of speech aerodynamics in normal and pathological subjects. The system utilises a combination of hardware and software to achieve its full capability. The hardware consists of:

- A two chamber face mask which collects the air escaping from the oral and nasal port and houses the microphones and air flow sensors.
- An electronics unit which houses the power and signal conditioning circuitry. The system's power is derived from the host PC.
- An interface card which resides in the host PC.

The software provides for the acquisition, processing and graphical display of data in the required form. The system is primarily targeted at Speech and Language Therapists and clinicians who deal with cases of cleft palate and velopharyngeal incompetency, but is also useful in many other areas.

The software enables the operator to perform a series of tests, to use the option to get real-time feedback on the subject's performance, and to analyse the acquired data. In addition, data can be stored and subsequently retrieved for further analysis and a hardcopy can also be obtained. Tests can utilise either a "standard" word list or a "custom" word list, which can be edited by the user (see Appendix I).

SPECIFICATION

Micro-computer requirement	An IBM or IBM compatible PC-AT (386/486) with a hard disk and a floppy drive. (Use of a co-processor is strongly recommended).
Operating System requirement	Ideally DOS version 5 or higher, but can operate under older versions.
Monitor requirement	Colour VGA or Super VGA.
Data Acquisition Card	Metrabyte DAS1202 interface card (supplied).
Equipment Hardware requirement	SNORS System
Supported Printers	Epson FX series, HP LaserJet and HP Deskjet.
Power Supply	Power is derived from the PC power supply. No external supply is required.

INSTALLATION

Make sure that the computer is switched OFF and install the Keithley DAS1202 interface card into a spare slot within your computer. The card is supplied ready to operate with the software provided, but can be configured for different addresses, if required (see APPENDIX for settings of the card and DAS1202 reference manual for further technical details and installation guide).

The SNORS hardware unit derives its power from the host computer (PC), so it does not have to be plugged into the mains.

Before you start running the software or before making a backup file, please ensure that you have the following files on the SNORS diskette:

SNORS.EXE

BAR.EXE

NEWSCOPE.EXE

SNORS.CFG

CALIB.DAT

DAS1200.CFG

DEMO.DAT

INSTALL.BAT

To install the software onto your hard disk, place the installation disk in your floppy drive (usually drive A:) and, from C:\, type 'A:\INSTALL↵'. All necessary directories will be created on your hard disk and the files will be copied to their correct places. The software is installed in directory SNORS.

Note: '↵' means: Press the "Return" key.

OPERATION

Make sure that the mask is connected to the input of the device and the output from the device is connected to the DAS1202 card; the mask connector is located on the box's front panel and the connector for the DAS1202 card is on the lead coming out of the rear of the unit. Make sure that the red Nasal and Oral airflow sensor outlet caps are in place on the mask transducers and allow a few seconds for the system to stabilise and also for the airflow sensors to reach a steady state condition.

Run the SNORS software by typing 'C:\SNORS\SNORS↵' from the C:\ prompt. At the main menu, select the "SCOPE" option, by using the UP('↑') or DOWN('↓') cursor keys to highlight the "SCOPE" box and then pressing "Enter" ('↵'). A new screen will appear with traces scanning across the screen. Check that the two airflow traces are approximately at zero and then remove the red sensor outlet caps from the mask transducers.

Position the mask on the subject's face such that the mask's partition rests comfortably on the upper lip but ensure that, at the same time, a good all around seal is formed between the mask and the subject's face. This ensures that there will not be any air leakage.

At this stage the subject should be asked to produce an oral sound (e.g., AAA, EEE, OOO) and the top waveform on the "SCOPE" screen should be monitored. Using the audio gain control knob on the front panel, the audio volume should be varied until an optimum sound intensity is obtained. For example in children and female subjects the voice tends to have a low intensity and it has been found that, in a majority of cases, they require significant amplification.

When the volume has been set, exit the "SCOPE" screen by pressing 'Esc' and return to the main menu.

TEST PROCEDURE

Once the option to carry out a test ("PERFORM TEST") has been chosen from the main menu, the operator is prompted with a series of questions.

The operator is first asked to select the period allowed for each word of the test. A period of either one, two or three seconds can be selected, by entering the appropriate number. The default value of two seconds will be used if the operator simply presses '↵' (Enter). In most cases, the default value will be suitable; however, it has been found that a longer time interval may be required for very young or disabled subjects.

Next, the operator will be asked whether the "Custom" test is required. Entering 'Y↵' will select the custom test. 'N↵', or simply '↵', will select the standard test.

The operator is then asked if data is to be saved. If the response is 'Y↵', the subject's name, name of the file, date of test and comments will be requested and should be entered, as follows.

Data File Name:	The program creates a file under this name in the current directory where the data will be saved. A file name can be up to 8 characters in length and can have up to 3 character for its extension.
Name of the Patient:	Patient's name can be up to 15 characters in length.
Date of Test:	A record of the date when the test has been carried out. Date information can be up to 15 characters in length and can be in any desired format.
Comment:	Any useful comment or relevant information regarding the subject up to 30 characters in length can be inserted here.

The computer then pauses and prompts the user with a "PRESS ANY KEY TO START" message. Once the subject is ready, the tests can start by pressing any of the keys on the keyboard. The words will be displayed on the screen. They should be read loud and clear into the mask. There are ten standard words: "BEGIN, TYPE, FIGHT, SEAT, CHEESE, SHOOT, SMOKE, KING, MISSING, END" which, by default, are built into the program; but, in addition, a set of ten User-Defined words can be chosen for display under the User-

Defined test option. This list can be altered at any time by editing the file SNORS.CFG, using any text editor (e.g. DOS EDIT).

At the end of the test run, raw data will be written to the hard disk (if the save option has been chosen). Data, are written in sequential blocks of binary format and their contents cannot be viewed by using the DOS commands. In the next step, calculations on the raw data are performed and results are displayed in a graphic 'Main Window'. Speech Envelope (red), Nasal Airflow (green) and Oral Airflow (yellow) are displayed

At this stage a dynamic zooming facility enables the user to choose and expand any part of the test which is required. This is achieved by moving the WHITE rectangle over the desired area and pressing the '↵' key on the keyboard. An expanded view is displayed in the 'Zoom Window'. This useful facility helps by allowing a closer study of the airflow during phonation of each individual word, and also of the events taking place prior to and subsequent to that word.

The rectangular zoom selection rectangle can be moved to the LEFT or to the RIGHT by using the corresponding cursor keys ('←','→') on the keyboard, and its width can be increased or reduced by using the UP('↑') or DOWN('↓') cursor keys respectively. Pressing ↵ displays the selected 'Zoom View' in the 'Zoom Window'. Pressing ↵ again makes the 'Main Window' active again, allowing a new selection to be made. **It is important that the entire zoom rectangle is visible on the screen when zooming** as, if part of the rectangle is off the screen, invalid data will be displayed. Likewise, if the width of the rectangle is reduced to a single line, further presses of the ↓ key will cause the rectangle to increase in size again. **This should also be avoided** as invalid data will again be displayed. The "Nasalance" value is also displayed in the bottom left-hand corner of the screen. This is the total nasal airflow divided by the total airflow (nasal+oral), **in the 'Zoom Window'**.

NASALANCE

The nasalance figure calculated by SNORS is based on the **total** airflow visible in the zoom window. If this window contains elements of zero flow or respiration, these will be included in the calculation. Periods of zero flow will simply reduce the sensitivity of the calculation and will not introduce any specific errors. Hence, small periods of zero flow, within the zoom window, are quite acceptable. Periods of respiration, however, will **significantly** affect the nasalance calculation. Thus, **it is most important that they are excluded from the zoom window**, unless it is required that their effect should be included.

The speech envelope channel is helpful in determining which parts of the flow waveform are due to speech and which are due to respiration – there should normally be very little sound during respiration. However, a little care should be exercised as breathing is sometimes audible. But, with a little practice and a knowledge of speech production, it should be fairly easy to select the appropriate sections of the waveform for use in nasalance calculations.

A third window, at the bottom right, explains the various key options and defines the three traces.

If required, the gain of the microphone or the flow can be increased in the zoom window. This is done by pressing the 'M' key (for microphone gain) or the 'F' key (for flow gain). Each press doubles the gain until the maximum is reached, at which point the gain falls back to the minimum value.

A hardcopy of the screen can be obtained by pressing 'P'. This gives a choice of either a Deskjet, LaserJet or Epson (dot matrix) printer. The correct printer should be selected by entering the appropriate number.

It is also possible to export the data to an ASCII file, for subsequent manipulation by a commercial data manipulation package. To export data, press 'E' and enter a valid DOS filename, when requested.

To exit from this screen, press 'Esc'.

DATA RETRIEVAL

A data file can be retrieved from the hard disk for viewing and analysis. This is done by choosing the "RETRIEVE DATA" option at the main menu. At the 'RETRIEVE DATA' screen, a list of all the data files will appear. The required file should be highlighted using the cursor keys ('←','↑','→' and '↓'), and then selected by pressing '↵'.

REAL TIME SCREENS

Scope

"SCOPE" provides a fast and efficient technique for instant evaluation of a patient's speech and training by means a of real time feedback. Speech envelope, Nasal Airflow and Oral Airflow signals are traced across the screen sweeping from the left to the right. As soon as the waveforms reach the extreme right side of window, the current screen is cleared and a fresh sweep is started.

The sweep speed can be increased or decreased by pressing the > or < keys, respectively.

The gain of any channel can be increased by pressing the 'M' key (for microphone or speech), the 'N' key (for nasal airflow), or the 'O' key (for oral airflow). Each press doubles the gain until the maximum is reached, at which point the gain falls back to the minimum value.

During the test, if required, a frame can be frozen by pressing 'F' before the trace has reached the extreme right. To restart the sweep press any key on the keyboard.

Press 'Esc' at any point to exit from this screen.

Bar

"BAR" provides a simple, real time display for use in therapy. A bi-directional, bi-colour bar appears in the centre of the screen. Movement of the upper bar, *upwards* away from the centre line, indicates *nasal* airflow – the greater the movement, the greater the instantaneous airflow. Movement of the lower bar, *downwards* away from the centre line, indicates *oral* airflow. Once again, the greater the movement, the greater the instantaneous airflow.

The simple nature of "BAR" makes it easier for clients to interpret than the more complex (but more informative) "SCOPE".

If required, the sensitivity of either the nasal or the oral bars can be increased by pressing the 'N' and 'O' keys, respectively. Each time a key is pressed, the sensitivity is increased until the maximum value is reached. At this point, the next press returns the sensitivity to its lowest value, from whence it can be increased again by further key presses.

APPENDIX I

EDITING THE CUSTOM WORD LIST

To edit the custom word list:

1. Quit from the main menu screen.
2. Type EDIT C:\SNORS\SNORS.CFG
3. Amend word list as required.
4. Type ALT + F
5. Select "SAVE" and press Enter.
6. Type ALT + F
7. Press X
   (this will return you to the C:\ prompt).
8. Type C:\SNORS\SNORS

APPENDIX II

TECHNICAL DETAILS

Programming Language	Borland C
DAS1202 board base address	HEX310
Interrupt request level	IRQ7
DMA	3
Input signal range	Bipolar ±2.5 Volts
Gain	x2
Number of channels	16
A/D conversion	Hardware controlled
Data sampling rate	800 Hz (100 samples per second per channel)
Data storage	Raw data saved in Binary format with header
DAS1202 Master clock frequency	10MHz
DAS1202 Wait state	Disabled

ALTERING SNORS HARDWARE SETTINGS

If the above hardware settings conflict with another board, already installed in your PC, it is possible to change them.

If you wish to alter the hardware settings of "SNORS" it is necessary both to edit the configuration file, DAS1200.CFG, and to physically set the switches on the board.

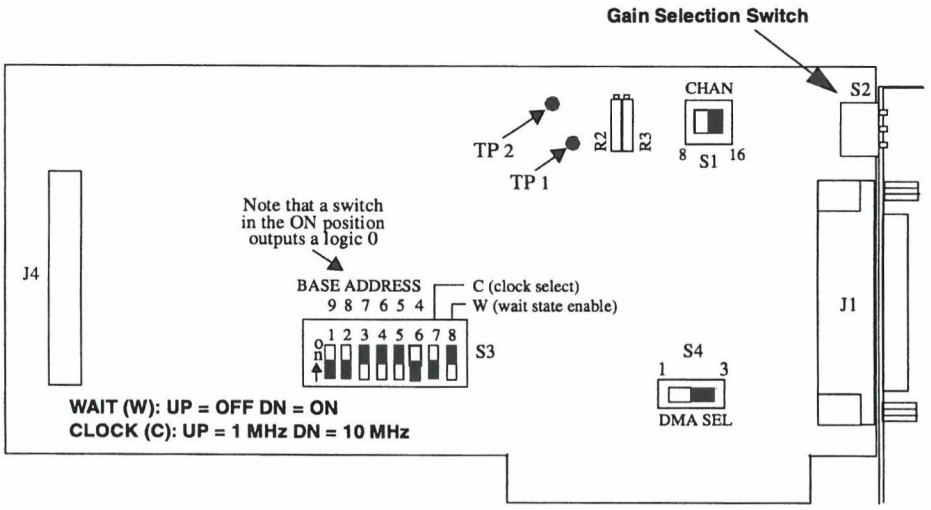
Configuration file, DAS1200.CFG

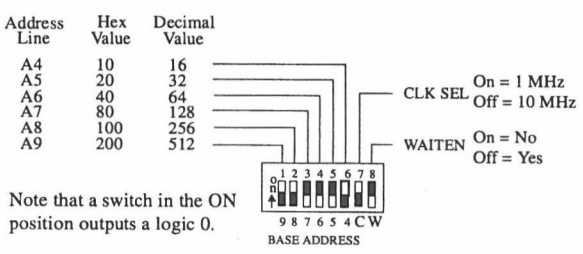
This file can be edited using any available text editor, such as DOS "EDIT" or WINDOWS "NOTEPAD". Please be careful only to alter the Base Address, DMA Channel or Interrupt Number. Changing any other setting may result in incorrect operation. The default file is as follows:

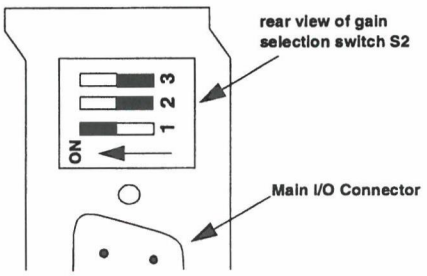
Board	0	
Name	DAS1202	
Address	&H310	[Base Address]
ClockSel	10MHz	
WaitState	NO	
ADChanConfig	Single-ended	
DMAChannel	3	[DMA Channel]
IntLevel	7	[Interrupt Number]
PortA	Input	
PortB	Input	
PortCL	Input	
PortCH	Input	
NumOfEXP16	0	
NumOfEXPGP	0	
NumOfSSH4A	0	
ADGain	1	

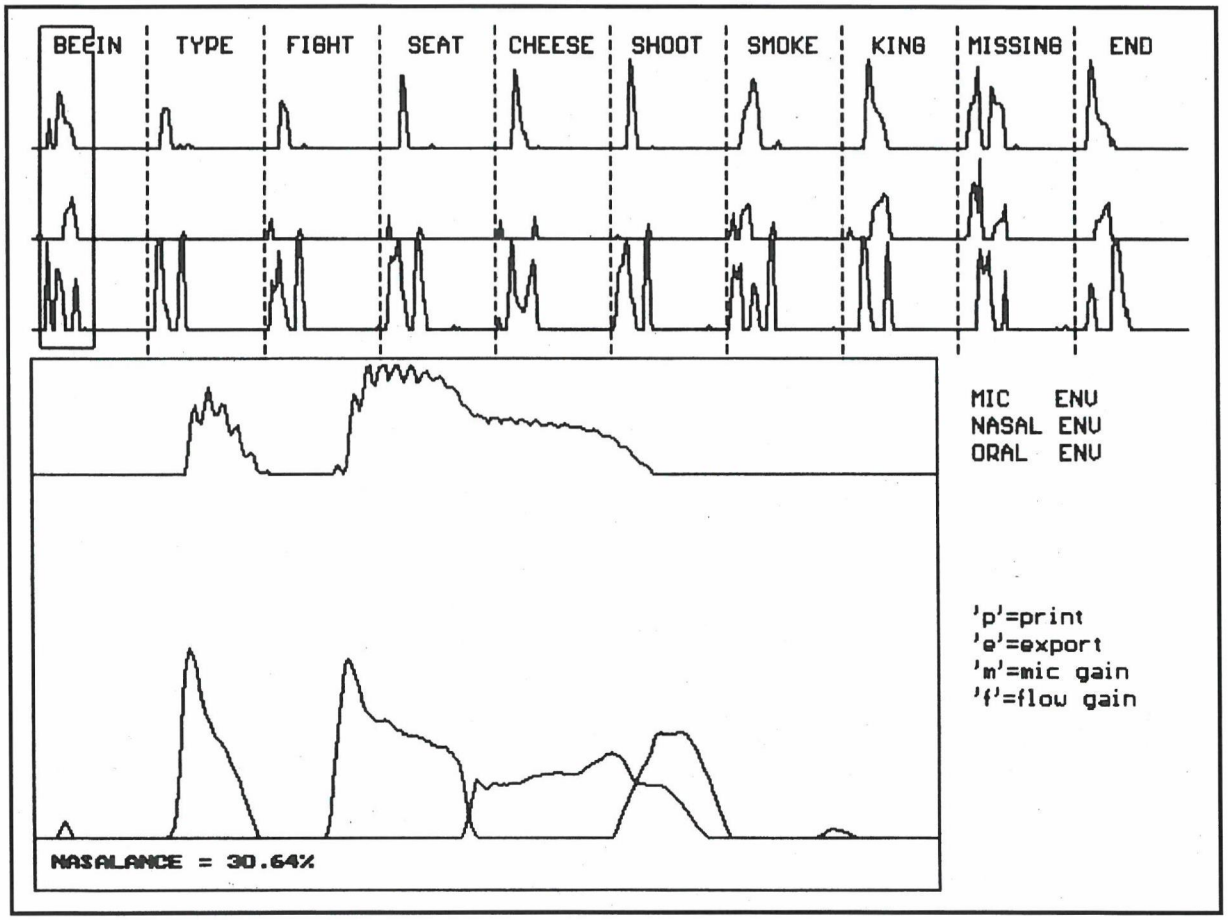
DAS1200 Board Settings

The DIP switch settings for the Keithley Metrabyte DAS-1200 board are shown below. Be careful only to change the Base Address and/or the DMA setting(s). Note: Interrupt settings are software controlled and do not require board changes.







APPENDIX III

SAMPLE PRINTOUT